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REPORT OF CHIEF OF BUREAU OF BIOLOGICAL SURVEY

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., September 16, 1925.

SIR: I have the honor to submit herewith a report of the operations of the Bureau of Biological Survey for the fiscal year ended June 30, 1925.

Respectfully,

E. W. NELSON,
Chief of Bureau.

Hon. W. M. JARDINE,
Secretary of Agriculture.

ORGANIZATION OF THE BIOLOGICAL SURVEY

The increasing occupation and development of the United States and its Territories makes it increasingly difficult to maintain even a fair representation of our once enormous natural resources in game and fur-bearing animals and game and insectivorous birds. At the same time the widespread herds of domestic stock and the extension of the farming areas have given predatory animals and harmful rodents of many species a stable and abundant food supply, under the influence of which their numbers increase and necessitate active control.

To accomplish the varied tasks involved in these problems calls for field and laboratory investigational work by trained specialists, and the maintenance of a warden service to safeguard Federal wild-life refuges and to enforce Federal game laws, as well as a force to conduct field campaigns to control animal and occasional bird pests. These activities also involve much educational and cooperative work. The work of the bureau is organized in seven divisions, as follows:

1. Economic investigations, A. K. Fisher, in charge. Necessary investigations are made and the organization and leadership furnished for cooperative campaigns throughout the country for the destruction or other control of predatory animals and injurious rodents.

2. Fur resources, Frank G. Ashbrook, in charge. Through experiments and investigations in fur farming and by close cooperation with associations of fur producers and the fur trade, studies are made of problems in the maintenance of the fur supply, both in the wild and under controlled conditions, and in the development of the fur industry.

3. Food habits research, W. L. McAtee, in charge. Studies are made of the food habits and economic relations of birds, reptiles, and amphibians; of the food resources of water areas suitable for migratory wild fowl; and of methods of increasing useful and controlling injurious birds.

4. Biological investigations, E. A. Goldman, in charge. Field and laboratory investigations are made of the wild life of the country, including technical studies to determine the classification of species, their life habits, and their migrations and distribution, for the purpose of mapping the natural life zones of this continent and of providing the fundamental scientific information necessary for the economic, regulatory, and other activities of the bureau.

5. Alaskan wild life, the chief of bureau and W. F. Bancroft, in charge. Problems concerned with the developing reindeer industry are studied, and assistance is given to native and other owners of herds; through representation on the Alaska Game Commission and in other ways fur production in the Territory is encouraged and ex-

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pert advice and assistance given in matters affecting the future of Alaska's resources in game; investigations are conducted and assistance given to help develop stock grazing and fur farming on islands within the the Aleutian Islands Reservation.

6. Game and bird refuges, Smith Riley, in charge. Sixty-nine Federal large game and bird refuges are administered in the United States, Alaska, Porto Rico, and Hawaii through warden service and inspections; hay is produced on the elk refuge in Wyoming for winter feeding of the elk; and disposal is made by transfer for restocking purposes or by sale of surplus animals on the five big-game preserves under the bureau's jurisdiction.

7. Protection of migratory birds, George A. Lawyer, in charge. Federal laws are administered for the protection of migratory game and other birds, and laws governing interstate shipments and importations from foreign countries of wild birds and mammals.

Plans have been made for a temporary reorganization following the resignation of Smith Riley, in charge of reservations. He will be succeeded by E. A. Goldman, by transfer from chief of biological investigations, and H. H. T. Jackson will be placed in acting charge of the latter division. George A. Lawyer resigned as Chief U. S. Game Warden on September 15, 1925.

INJURIOUS WILD ANIMALS

A constantly increased food supply stimulates the increase of wild animals dependent upon it. The extension of farming and stock growing in their various branches over the entire United States has provided the needed food supply, and under its influence in various places in the West coyotes and wolves have rendered it impossible successfully to grow certain kinds of livestock upon which these animals prey. In other areas the multiplication of rodents with almost unbelievable rapidity about grainfields has increased the difficulty of successful production. Long experience has demonstrated that it is an economic necessity to combat such injurious wild animals in order that the losses to agriculture and stock growing may be reduced within tolerable limits.

Furthermore, the rapid and continuous spread of rabies from its outbreak in a single focus in California in 1909 through six of the Northwestern States before it was controlled, with its appalling losses of livestock and a list of more than 2,000 persons bitten by rabid animals, of whom about 60 died, evidences the danger of permitting predatory animals to maintain themselves in great numbers in the midst of territory generally occupied by civilized people.

The losses of crops, livestock, game, and poultry from these animals have run into hundreds of millions of dollars a year. Campaigns against these pests, which are being led by experts of the Biological Survey, mainly west of the Mississippi River, have very greatly reduced their numbers and have vastly reduced the annual losses from this source.

Little objection can be raised to the continuance of a limited number of predatory animals in national parks and in wilderness areas remote from civilization, so long as they do not prove too destructive to the other wild life there. It must be taken into consideration, however, that with the growing numbers of hunters and the improved facilities for getting into the haunts of game, either the number of hunters seeking game or the number of predatory animals permitted to roam the forest must be reduced, or the resulting drain on game will mean its extermination.

Experience with wild animals in this country indicates that bobcats and coyotes will continue to exist in many areas within our territory in the distant future. Their numbers can be reduced in the districts where their destructiveness is most marked until losses are almost entirely eliminated, as has been well demonstrated within recent years. That these animals really will be exterminated in our territory before a very long time, is beyond reasonable probability. The case of the coyote is sufficient proof of this fact. Of recent years these animals, although constantly being destroyed as stock killers and for their pelts, still have not only continued to exist in practically all their former territory, but have vastly extended their range and now occur from Costa Rica, in Central America, to the mouth of the Mackenzie River, in Canada, and from wooded parts of Indiana to the Pacific coast. They possess the same extraordinary adaptability to environment which has enabled red foxes to persist so successfully in New England after several hundred years of pursuit by civilized man.

Less conspicuous but far more destructive in the aggregate than the predatory animals are the rodent pests

that not only reduce the forage available for livestock on the ranges but also are vastly destructive to agricultural products, as well as to roads, irrigation systems, levees, and railway embankments. To this list may be added the enormous losses of food and other products and property by the depredations of house rats. The control of each of these pests presents a special problem, requiring investigations of the habits, distribution, and economic relations of the animals. This work the Biological Survey is continuing both in the laboratory and the field. A field organization is maintained in most of the Western States to coordinate operations against these animal pests with the work of other Federal, State, and local agencies. Good progress is being made and each year the losses from this source are decreased.

Federal funds in the amount of $429,642 were available for use during the year in destroying wild-animal pests on the public domain and for cooperative work elsewhere. Of this sum $270,967 was used in the destruction of predatory animals and $158,675 for the control of rodents. Organized work was conducted in 21 States, which provided cooperative funds totaling $839,568 from State appropriations and other sources. Approximately $389,374 of the cooperative funds were expended for the destruction of predatory animals and $450,194 in rodent-control work.

PREDATORY ANIMALS

The conditions under which intensive work has been carried on for the control of predatory animals have shown marked improvement during the past 10 years. Originally organized to prevent wolves, coyotes, and other marauders from destroying livestock on national forests and other public domain, it soon became apparent that to assist the livestock industry adequately the work must be extended to cover State and private lands also. To this end, the aid of State and local agencies has been enlisted, and all efforts have been so successfully coordinated as to prove a gratifying demonstration of the possibilities of a correlation in which many organizations and many men can work together to reach a common objective.

Cooperating State agencies have included State departments of agriculture, livestock commissions or boards, game commissions, agricultural extension departments, county organizations, and stockmen's and farmers' associations, as well as individuals. Predatory-animal work has been in progress in 16 States—Arizona, California, Colorado, Idaho, Michigan, Minnesota, Missouri, Montana, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Arrangements also have been made whereby agencies controlling Federal lands, as the Forest Service and the Bureau of Animal Industry of the Department of Agriculture, and the Office of Indian Affairs and the National Park Service of the Department of the Interior, may participate and receive assistance in the work. The Bureau of Plant Industry and the Bureau of Chemistry of this department also have aided in consultations and laboratory investigations.

In order to cover economically the enormous areas infested by predatory animals the voluntary service of many farmers and stockmen has been utilized. These men were instructed how to treat their own ranges and prosecute the work on definite plans. A force of 402 trappers and poisoners has been employed under the bureau's supervision during the year and paid from Federal and State funds and from funds of other cooperating agencies. Skins having a market value and also the scalps of animals taken in trapping and hunting or found after poisoning operations were turned in by them as evidence, and include 352 wolves, 37,255 coyotes, 2,945 bobcats, 61 Canada lynxes, 228 mountain lions, and 201 bears. And it is estimated that about 80,000 additional coyotes were killed and their skins and scalps not taken, as it is not practicable to collect many carcasses after extended poisoning operations.

Wolves.—Gray or lobo wolves have gradually yielded to the intensive drive to clear them from the livestock-producing sections of the country and have now been reduced to such small numbers that there is only an occasional lone survivor or pair known to exist in the areas devoted to livestock production, aside from animals which cross into the United States from Canada or Mexico. Owing to their destructiveness of livestock and game, these animals can be tolerated only in unsettled country. Aside from purely economic reasons, their elimination in occupied country is essential to an intelligent conservation of the useful and attractive forms of wild life. This does not mean complete extermination of the species, for wolves will doubtless continue to exist indefi-

nitely in the wilder parts of Canada and Mexico, where they now occur in large numbers.

Skilled hunters have been detailed to take destructive individuals wherever they appear and to patrol the borders, especially in Arizona and New Mexico, for those animals coming across the international boundary. Of the 31 wolves taken in New Mexico during the year, the greater part are believed to have come from Mexico, and of a like number killed in Arizona 21 had recently crossed the border. Despite unremitting effort only 31 wolves were taken in New Mexico, 31 in Arizona, 1 in Colorado, 1 in Utah, 1 in Wyoming, none in Idaho, 33 in Montana, and none in South Dakota, and this indicates the scarcity of these animals in their former strongholds. So far as known, scarcely a litter of young wolves was permitted to escape in these States during the year.

Reports during the current year indicate that the previous intensive efforts to take the outstandingly destructive wolves have been successful and have left relatively few, and these are wide-ranging animals which frequent the less-settled sections of the country. Ranges once heavily infested are now reported as showing no signs of wolves for more than a year, a condition prevailing for the first time in the memory of old-time stockmen of the West. As the wolves become fewer, it becomes increasingly difficult to locate them, for they travel long distances and change their range frequently. In spite of this, however, the hunters assigned particularly to wolf work have become so skillful that it usually takes only a few days to capture any wolf reported doing damage.

Coyotes.—Careful study of local conditions in consultation with stockmen and the execution of orderly plans for the systematic treatment of entire areas affected have made it possible to reduce the numbers of coyotes and to prevent much of the damage by them. Through the steady drive against these animals which has been in progress for approximately 10 years there is now probably not 1 coyote where before there were 10. Because the work has been stressed in livestock-producing sections, the losses over great areas of summer and winter ranges of sheep and about the lambing grounds have been practically ended. This in no wise implies that these cunning animals are becoming exterminated, for an ample breeding stock will continue to exist in many areas far in the future.

Mountain lions.—Careful study of the seasonal movements of mountain lions throughout their range has made control work possible. Although ordinarily hunted with dogs and rifles, they are also trapped and poisoned successfully, particularly through the use of oil of catnip as a bait. A few especially skillful men are employed regularly in hunting these animals and have dogs well trained for the purpose. Their work is supplemented by the employment for short intervals of local stockmen who are experienced, properly equipped, and thoroughly familiar with conditions in their own locality. The largest kill during the past year was made in Arizona, where 127 mountain lions were destroyed. Throughout the West 228 were taken, making 1,464 since this work was organized in 1915.

An unusual and unfortunate incident occurred in December, when a boy about 13 years old living near Malott, Okanogan County, Wash., was attacked and killed by a mountain lion within half a mile of his home, and the partially devoured remains were not found until several hours later. Tracks in the snow gave mute testimony of the events which had occurred during the pursuit till the lion leaped upon and killed his human prey. Due to the obliteration of the tracks and other signs by the large number of local hunters who took up the pursuit seeking the local bounty that was offered, the Federal-State hunters were unable to find the trail. A local rancher, however, while trapping for coyotes a month later about 4½ miles from the scene, caught a 3-year-old cougar by one toe in a No. 3 trap. Examination of the stomach disclosed a bolus mainly of matted hair. This mass was carefully analyzed by one of the experts of the Biological Survey and identified as human hair similar to that of the boy, along with two pieces of blue denim cloth, one piece of white cloth similar to trouser pocket material, and a discharged .38-caliber cartridge shell which the boy had evidently carried in his pocket as a trinket.

Bobcats and lynxes.—Throughout most of the important livestock ranges the numbers of bobcats and lynxes have been materially reduced through hunting by private trappers for furs and by organized campaigns against them. During the year 2,945 bobcats and 61 Canada lynxes were taken by hunters operating under bureau supervision. Bobcats are readily caught by experienced hunters with trained dogs

and traps. Though more difficult to poison than many other predatory animals, considerable numbers are trapped with oil of catnip as bait. The general situation as regards these animals is quite satisfactory, for they can be promptly destroyed wherever individuals become addicted to killing livestock.

Bears.—Bears are considered game animals in a number of States, and as such receive protection. Hunters of the Biological Survey are strictly instructed to kill only such individuals as are known to be destructive to livestock or, in cooperation with State game departments, bears destructive to other game.

RABIES CONTROL

The measures employed to reduce the numbers of coyotes and bobcats, the principal wild-animal carriers of rabies, have served to reduce the possible incidence of this disease as compared with conditions existing about 1916 and 1917, when rabies was distributed over a vast area in the Western States by these and other carriers. Wherever outbreaks of rabies have occurred, either among wild animals or domestic dogs, the force of trained men employed by the Biological Survey and its cooperators has acted so promptly with local health officials and livestock sanitary boards in destroying the predatory animals in the district that the duration of the outbreak has been short and of minor intensity.

In Colorado the outbreaks noted in the previous annual report of the bureau were controlled, the spread of the disease was checked, and no new cases have been reported in recent months. Outbreaks of rabies were suppressed also on the Klamath Indian Reservation and in several places in eastern Washington. Sporadic recurrences of this disease are reported throughout the territory previously affected, but the present cooperative organizations have the situation so well in hand and are in a position to move so quickly that the disease is not again likely to escape from control and spread over an extensive area.

FOOT-AND-MOUTH DISEASE AMONG DEER

The series of outbreaks of foot-and-mouth disease in various parts of California in 1924 so vigorously handled by the Bureau of Animal Industry by fall were entirely suppressed among domestic livestock, but not before the deer in the forests on the western slope of the Sierra Nevada Mountains in Stanislaus County had become infected. The range of deer is continuous up and down the entire length of the Sierra Nevadas, and across into the Coast Ranges of California and into Oregon and Nevada so that this infection presented possibilities of appalling consequences to the economic interests of California and the entire West.

In this emergency the assistance of the Biological Survey, with its trained force of hunters, was requested to isolate the deer and suppress the disease to prevent what might result in a national catastrophe. Under the direction of the field representatives of the bureau a force of more than 200 hunters and their camp assistants was established in a cordon encircling the infected area to prevent any possibility of diseased deer passing the line into other territory.

The work went on throughout the winter and 2,249 deer that had been infected with foot-and-mouth disease were killed. As the result, before the end of the fiscal year the hunters ceased to find evidences of recently infected deer, although the work was continued as a form of insurance. When the spring of 1925 opened and the deer returned to the high Sierras, guards were established in all the passes used by them in crossing the mountains toward the State of Nevada in order to prevent any possible passage of the infection to that State. Apparently this work was completely successful.

Certain persons, who learned of the considerable number of deer being killed, adversely criticized the operations. This, however, it is believed was through lack of appreciation of the danger.

In this work the Biological Survey cooperated with the Bureau of Animal Industry, the Forest Service, the National Park Service, the State department of agriculture, and the State game commission. In the spring of 1925 special efforts were required to prevent the spread of this disease among the deer in the Yosemite National Park.

INJURIOUS RODENTS

Rodent-control operations during the past 10 years show a most gratifying development in methods, in plans of field operation, and in the quantity and character of work accomplished, and the past year shows a steady progress. The direct benefits resulting from control operations against

the rodents which cause heavy losses in farm crops and forage grasses, and in truck and berry farms, orchards, vineyards, and nurseries, have resulted in a constantly increasing demand for this service. The first requests for assistance were in measures against the more conspicuously destructive rodents, but the demonstrated value of this control work, together with closer observation as to the destructive activities of rodents generally, has led to calls for assistance in operations against other less conspicuous but equally or even more destructive forms.

Particular attention has been given to correlating the efforts of the bureau with those of other Federal, State, and local agencies so as to avoid duplication in rodent-control operations and to concentrate upon the problem all available forces. Only in this way have the large-scale operations now in force been possible.

The bureau has had the hearty cooperation of the Office of Cooperative Extension Work and of the extension-service organizations of the agricultural colleges; and the work of county agricultural agents has been an important factor in bringing its service to the attention of landowners and accomplishing the local organization necessary to make its work fully effective. State departments of agriculture, county commissioners, and many agricultural, horticultural, and livestock organizations have participated, and where the work involved operations on Federal land, the Forest Service and the Bureau of Animal Industry of this department, and the Office of Indian Affairs and the Reclamation Service of the Department of the Interior, have cooperated to the fullest extent.

In cases where rodents serve as carriers of disease-producing organisms, arrangements are made to coordinate the work of the bureau with that of the United States Public Health Service of the Treasury Department and with State, county, and municipal health organizations. The field organization of the bureau has been built up with a view to carry results of its investigational work to the public in the most practical and economical way and to articulate this service with regularly established agencies within the States.

Prairie dogs and ground squirrels.—Improved conditions have been evident on the ranges from which prairie dogs and ground squirrels have been largely eradicated, and the harvesting of full instead of partial crops has added materially to the returns from farming operations. Drought in many parts of the West emphasized the serious competition of these animals with livestock in the utilization of forage plants. In many areas it was necessary to remove livestock to pasturage elsewhere while the prairie dogs and ground squirrels continued to exist on the remaining vestiges of pasturage, preventing seed from being produced and even digging up the plants by the roots.

Such conditions convince stockmen of the desirability of clearing the ranges of these unwelcome competitors, so that the pasturage may be improved for the benefit of their herds. Rodent eradication is becoming recognized as one of the most direct and practical means of range improvement and a step that is absolutely essential if progress is to be made by the adoption of other range-improvement methods. Under the drought conditions existing on the open ranges, in some areas these rodents migrated in great numbers to cultivated fields and made serious inroads into the crops. As indicative of the concentration of these animals, 225 dead prairie dogs were picked up from 15 acres in a grainfield near Flagstaff, Ariz., following application of poison, but the number thus destroyed must have been far greater, since most of the poisoned prairie dogs die below the surface, where they can not be seen.

Desire to produce grasses, livestock, and farm crops instead of prairie dogs and ground squirrels has created a demand for assistance in the eradication of these pests throughout the West. Campaigns to destroy prairie dogs and ground squirrels resulted in the first treatment with poison baits of 11,552,667 acres of Federal and private lands, and follow-up work to eradicate most of the survivors on 7,704,863 acres. This, added to work accomplished since 1916 in Arizona, California, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming, makes a total of 12,637,634 acres of Federal and 115,915,033 acres of State and private lands from which a large percentage of these pests have been destroyed.

In addition to paying the cost of poisoning operations on their own lands, farmers and stockmen have continued to contribute thousands of dollars' worth of labor in distributing poison on adjacent Federal lands. State officials and county commis-

sioners have aided by providing revolving funds to purchase poison supplies. The bureau continued to negotiate the purchase of poison materials in wholesale quantities for use on Federal lands and for cooperators, with a resultant saving in the cost of operation to the cooperators of many thousands of dollars. The saving in crops and range grasses from the work during the year is estimated at more than $6,500,000. This does not take into account the permanent benefits which have resulted from clearing the rodents from other areas during previous years.

Seventeen counties are reported cleared of prairie dogs, and from 95 to 98 per cent of the prairie dogs and ground squirrels have been eliminated from many others. Practically complete protection of crops has been obtained where poisoning operations have been conducted systematically in accordance with the bureau's demonstrated methods. Introduction of new crops into the western farming areas is promptly followed by attacks by rodents. This makes necessary constant development and adaptation of methods to meet the advancements in western agriculture.

County agricultural agents have been active in stimulating interest in this work and in preparing quantities of the poisoned grain for local use. A total of 1,573 tons of poisoned grain have thus been prepared and distributed under the supervision of the bureau's representatives and cooperative State and county officials. Calcium cyanide has been successfully employed against the Columbian ground squirrel in Idaho, Washington, Oregon, and Montana, and is being used to supplement poisoning with strychnine-treated grains; 215,640 pounds of this fumigant have been used for the purpose. Carbon bisulphide has also been employed in a similar way, 664,522 pounds having been used during the year. Generally it costs more to apply fumigants than poisoned-grain baits, hence they are used chiefly in follow-up treatment to complete the eradication of the few prairie dogs or ground squirrels which remain after poisoning and also during seasons when grain baits are not effective.

Pocket gophers.—Demonstration by the bureau that the control of pocket gophers is feasible and that it can be accomplished at moderate cost has resulted in increasing operations against these pests in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, and Washington. Interest in the control operations is developing rapidly as the extent of damage caused by these rodents in orchards, vineyards, alfalfa fields, and truck crops, and the serious injury which they do to levees, irrigation ditches, and railroad embankments becomes increasingly evident.

Water-users' associations and officials of the Reclamation Service are taking an active interest in the control of pocket gophers in irrigated sections because of the resultant savings in the cost of ditch-bank maintenance, and the protection afforded against damage to irrigated crops and orchards.

Many railroad lines are inaugurating pocket-gopher control work, both to protect their railway embankments and to aid the people of the communities they traverse by eliminating this source of infestation of the land adjacent to their right of way.

Demonstration farms on which pocket gophers are eradicated in cooperation with the owners have been established in a number of States, enabling the farmers in the vicinity to learn the methods employed and to see the benefits accruing.

Jack rabbits and cottontails.—Migration of jack rabbits from the open ranges into farming areas in search of food has been noted in many sections during the year. The invasion of rabbits in large numbers into cultivated fields threatened enormous damage to crops in Arizona, Colorado, Idaho, New Mexico, Oregon, South Dakota, Texas, Utah, and Washington. In some instances, where operations against them were not started in time, crops were destroyed.

Field representatives of the bureau demonstrated methods for destroying these animals in various localities, and great numbers of the rabbits were killed, thus saving many crops. In Roosevelt County, N. Mex., 20,000 rabbits were killed during an intensive two weeks' poisoning campaign, and it is estimated that not less than 150,000 were destroyed during the summer. In Washington, 77,900 were destroyed by poisoning and drives, in Utah 180,000, and in two counties of Oregon 200,000 in poisoning campaigns.

Owing to the extreme variability of jack rabbits in taking poisoned baits, it is often necessary in launching a campaign to conduct preliminary investigations to learn their food preferences. This was done in Morrow and Umatilla Counties, Oreg., where jack rabbits were coming in great

numbers from the open ranges to the cultivated crops. A poisoning campaign resulted in killing more than 200,000 of them which were counted, in addition to great numbers not found. As a result, the rabbits did only slight damage in most districts, as it was possible to kill them as fast as they moved in. In this campaign 1,445 ounces of strychnine were used, and some actual counts showed kills from 200 to 742 rabbits for each ounce of this poison.

Damage by cottontails to orchards, truck farms, and gardens was reported from many sections of the country. Since these animals are usually regarded as game they are ordinarily kept down to moderate numbers by hunters. Under these circumstances, the bureau has recommended protective devices which have afforded relief where damage was being done.

The fact that tularemia, a deadly epizootic disease among both jack rabbits and cottontails, may be communicated to man as a disabling and sometimes a fatal disease, is added reason for the control of these animals and for care in handling and dressing their carcasses. The bureau has kept in close consultation with the United States Public Health Service in reference to this aspect of the control problem. Valuable cooperative work was accomplished during the year in connection with an outbreak of tularemia in the vicinity of Carlsbad, N. Mex., in which thousands of jack rabbits succumbed to the disease and at least 17 persons were affected, one case terminating fatally.

An article entitled "The European Hare in North America," reviewing the history of its introduction, spread, present distribution and abundance, value as food, depredations, and control measures, was published during the year in the Journal of Agricultural Research.

Woodchucks. — Woodchuck control proved to be an important development during the year. Originally confined chiefly to rough, stony land, where they did relatively little damage, woodchucks have spread into cultivated areas and established themselves along levees, hedgerows, and other favorable retreats, and have invaded orchards and grain and root crops. By girdling orchard trees and feeding upon the products of the farm, woodchucks have become a pest of considerable importance. In the banks of levees their burrows frequently cause breaks in time of high water which are expensive to repair, in addition to flooding adjacent farms and destroying crops, and in bridge abutments and along culverts they are responsible for serious washouts to roads.

The Biological Survey has conducted investigations and determined practicable methods of fumigating woodchuck burrows with carbon bisulphide or calcium cyanide. In Indiana, Illinois, New York, and Maryland 329 demonstrations were given and attended by 4,934 landowners. In 24 counties in Indiana, 92 demonstrations were attended by more than 2,000 farmers, and as a result 20,000 pounds of calcium cyanide were used. Similar interest in the other demonstrations was evidenced by a number of counties appropriating funds to purchase fumigating material in wholesale quantities.

In the Rocky Mountain and Pacific Coast States woodchucks are locally destructive, consuming considerable quantities of forage about mountain meadows and attacking orchards, alfalfa, and other farm, truck, and garden crops. The use of poisoning methods demonstrated by field representatives of the bureau has served to put a stop to much damage, and the work bids fair to grow rapidly and to result in the control of these rodents.

Mountain beavers are reported to be increasingly troublesome in sections of western Washington, and especially in areas where reforestation is being attempted and on berry farms and truck gardens. Methods of trapping and poisoning them have been demonstrated and assistance rendered in preventing damage.

Wood rats are widely distributed throughout the West, and while they usually are of little economic importance, it has been found that they interfere seriously with reforestation. Attention has been directed toward stopping their destructiveness, especially to the redwood and Douglas-fir seedlings in the reforestation projects of several lumber companies along the Pacific coast. Damage by wood rats to seedling trees has run as high as 50 per cent on some of these areas, an important factor in the success or failure of reforestation projects, in some of which more than 3,000,000 seedlings are being produced. The cost of transplanting each acre of cut-over land exceeds $12, and where damage from wood rats approaches 50 per cent the necessity for their elimination is obvious. Continued effort is being made to work out practical measures for their control.

Field mice.—Lessened damage by field mice during the year is largely due to the demonstrations given in many States where these rodents appeared in numbers and proved destructive in orchards and to various truck and garden crops. In Idaho there was a heavy migration of mice from the fields in the vicinity of the Boise River Valley, and while serious injury to fruit trees was threatened, a large part of it was prevented by the prompt use of poisoned grain, 3,960 pounds of which were distributed. Mice also developed threatening numbers in orchards of Washington and in other sections of the West, but prompt use of poisoned grain reduced their numbers so that little actual damage was done. Pocket mice appeared in destructive numbers in some of the grainfields, and 365 farmers treated 75,000 acres with 21,000 pounds of poisoned grain in infested places, resulting in complete protection to the fields. In the Eastern States investigations were continued upon pine mice, and assistance was rendered as requested in control measures to protect orchards, vegetable crops, and flower bulbs.

House rats and mice.—Because of the enormous damage to property and the serious menace to public health in the presence of rats and mice in the United States, the Biological Survey has continued investigations of methods for the control and elimination of these rodents and has aided in their control through furnishing publications, making demonstrations, and organizing local campaigns. Control has been made simpler as the public becomes aroused to the necessity of repressive measures and is adopting them more widely. The bureau has emphasized important measures of rat control, including rat-proof construction and repair of buildings, closing basement windows and other openings through which rats can gain entrance, disposing promptly of garbage and piles of refuse where rats find food or shelter, poisoning and systematic trapping, fumigating rat burrows with poisonous gases, using effective rat dogs, and organizing community drives to kill the animals, and to stimulate popular demand for the permanent improvements which are required to eliminate them. Improved sanitary conditions have invariably followed these campaigns.

In cooperation with the Bureau of Animal Industry, work was done in California in destroying rats in buildings where foot-and-mouth disease had occurred. Demonstrations have been given and campaigns conducted in Arizona, California, Colorado, Idaho, Illinois, Indiana, Kansas, North Dakota, Oregon, South Dakota, Utah, Washington, Wisconsin, Wyoming, and the District of Columbia.

During the year investigations have been conducted to improve methods of combating rats, particularly about poultry houses, because of the destructiveness of rats to eggs and young chicks, and of their serving as possible carriers of avian tuberculosis. Although much of the rat-control work has been done in agricultural communities, the bureau has also cooperated with public-health and other municipal officials in the conduct of campaigns, of which the following is typical:

During the annual fire-prevention week in Denver, Colo., firemen visited all the schools of the city and, mentioning rats as one of the causes of destructive fires, requested support for the rat campaign to be held the following week. As a preliminary step, arrangements were made for the proper disposal of garbage, and publicity of the campaign was carried on through newspapers, the radio, posters, show windows, and advertisements. Many business houses ran a line in their regular advertisements calling attention to the rat campaign. Preceding the campaign, inspectors of the city health department met for instruction in mixing and placing poison and in the methods of baiting and setting traps. Each was made responsible for visiting every store in the section assigned to him to see that poison was put out or traps used according to the local needs and to give demonstrations in their use. Wholesale houses furnished supplies of meat and other bait materials. As a result thousands of rats were killed and, what is even more important, the people received instruction in the simple, practical procedure required for the control and elimination of these destructive pests.

Porcupines are becoming of increasing economic interest because of their destructiveness to forest trees and seedlings and their occasional raids upon corn, raspberries, and fruit trees, particularly cherries and prunes, and their feeding on and wallowing in alfalfa. Investigations are being conducted to determine improved methods of controlling the damage wherever these animals occur in destructive numbers.

MOLES

Investigations have been carried on to determine the simplest practical methods for the control of moles, complaints of damage by which continue to be received. The bureau has demonstrated and furnished information through correspondence and publications on methods for the control and elimination of these animals where they are doing damage in lawns, gardens, truck farms, pastures, and hay meadows.

EXHIBITS AT FAIRS

In cooperation with the Office of Exhibits the bureau has prepared material for use in the regular fair circuits and at stockmen's and sportsmen's shows, particularly in Arizona, California, Colorado, Montana, Oregon, Texas, Washington, and Wyoming. Damage by rodents and predatory animals has been graphically shown along with suitable control measures. Mounted specimens of some of the more important of these pests have been used, and field representatives of the bureau have added local interest by including live specimens of such animals as ground squirrels, prairie dogs, pocket gophers, wolves, and coyotes. Experienced leaders have been present to discuss these subjects with visitors and to furnish advice regarding field operations in progress for the control of injurious mammals. This educational work has proved valuable in stimulating cooperation in organized efforts for the control of wild-animal pests.

FUR RESOURCES

The study and conservation of fur-bearing animals has been for many years one of the projects of the Biological Survey, and activities in this line have included the rearing of fur animals in captivity, investigations of their diseases and parasites with methods for their control, the study of conditions on private fur farms, and the preparation of bulletins on the maintenance of the supply, both by legal protection in the wild and by production on fur farms. The growth of this work made it advantageous to organize a new unit in the bureau, the Division of Fur Resources, established on July 1, 1924, the objects of which are (1) to make more generally known the commercial importance of fur in industry; (2) to emphasize the need of maintaining the supply of raw material; (3) to explain methods by which this supply may not only be maintained in quantity but improved in quality; and (4) to continue studies on an experimental fur farm in the production of fur animals under controlled conditions. The success of the bureau's educational work to develop a fuller realization of the fact that fur is a valuable natural resource which must be conserved if it is to be perpetuated is becoming increasingly evident.

FUR FARMING

Fur farming in the United States is steadily developing, and certain phases of the industry are coming to be a permanent addition to agricultural production. From questionnaires sent annually to fur farmers, lists of fur-animal breeders and their addresses in the United States and Alaska are compiled. Returns from these questionnaires indicate that there are approximately 2,000 farmers in the United States and Alaska engaged in the production of one or more species of fur-bearing animal, the majority of whom are raising silver and blue foxes. The total investment in the business is between $15,000,000 and $18,000,000.

Constant effort is being made to obtain information essential to the requirements of this growing industry. Fur farms in the United States and Canada have been visited for the purpose of learning improved methods in breeding, feeding, and handling fur animals and to study outbreaks of contagious disease and parasitic infestation, the latter to enable the bureau to advise ranchers how to combat similar outbreaks. A bulletin in press at the close of the year on blue-fox farming in Alaska will be of great use to those engaged in the industry as well as to those contemplating rearing blue foxes, either on islands or in fenced inclosures.

The bureau is also in touch with the progress of fur farming in foreign countries, particularly in Europe, where the industry has had a steady but quiet growth. During the past year several shipments of silver, cross, and red foxes, skunks, raccoons, and minks have been made from this country to Norway, Sweden, Scotland, England, France, and Switzerland. Fox ranches have been in operation for several years in Norway and Scotland and in the wilder parts of Northumberland and Yorkshire, England. The French Government was represented at the fox show held by the American National Fox Breeders Association at Minneapolis by a special

commissioner, who purchased several breeding foxes for use on the disabled war veterans' farm at La Havre, France.

Fur farms in Alaska.—Of the 10 islands in southeastern Alaska under the jurisdiction of the bureau available for the propagation of foxes 9 remain leased, and from reports of operations the lessees are meeting with fair success. Great interest is being manifest in blue-fox farming, and practically all suitable islands throughout the southern and southeastern parts of the Territory will probably be occupied for the purpose within the next year. During 1924 more than 200 fur farms, mainly for blue foxes, were being operated in southeastern Alaska.

The fact that 92 permits to capture land fur-bearing animals for propagation were issued during the year is indicative of the increasing interest in this industry on the mainland and in southeastern Alaska. Of these permits 33 were for white foxes, the propagation of which is an extremely promising venture by residents of the Seward Peninsula and the coast of Norton Sound.

At the end of the year 75 permits had been issued for the production of foxes in the Aleutian Islands Reservation. The reports indicate that fur farmers are meeting with fair success, the conditions improving from year to year.

Experimental fur farm.—The experimental fur farm of the Biological Survey, at Saratoga Springs, N. Y., is now fully equipped for carrying on extensive experiments in feeding, breeding, and handling fur-bearing animals as well as for studying their diseases and parasites. Efforts will now be directed toward the building up of a breeding herd of foxes. The first purebred silver foxes owned by the Department of Agriculture were purchased during the year. There were 23 fox pups born at the experimental fur farm this year, all of which are doing well.

Experiments conducted at the farm have shown that the general principles of feeding, breeding, and sanitation as they affect the production of domestic animals can be applied to the production of fur-bearing animals. Breeding experiments in progress tend to prove that the characters of a "samson" fox (a fox which lacks the guard hairs and thus produces a nearly worthless pelt) are inherited and can be transmitted, rendering such animals valueless as breeders. The wrong kinds of food and of methods of feeding as well as parasitic infestation are factors in producing inferior pelts, and further experiments are necessary to determine how they affect the quality of the fur.

Studies of the animals during the mating, gestation, and whelping periods are being continued, and improved methods of handling diseased animals during treatment have been devised and the data are being assembled for publication. Information regarding the tolerance of foxes to various drugs has been published in an article in the Journal of Agricultural Research (April, 1924) under the title "Anthelmintic Efficiency of Carbon Tetrachlorid in the Treatment of Foxes."

Various types of dens and pens have been constructed at the experimental farm to ascertain the kind best for the production of foxes in captivity. Drawings of those found most practicable have been prepared, and blue prints will be made available for free distribution.

During the year many visitors from all parts of the United States and Canada have inspected the farm, which is open to the public from 10 a. m. to 4 p. m. on Wednesdays and Sundays from June 1 to December 1.

COOPERATIVE WORK

In dealing with the protection of fur animals in the wild the policy of the department is one of cooperation and coordination and not control. The maintenance of the fur supply in the wild must be brought about mainly through the protection afforded by State laws, but the Biological Survey by investigations and educational work in cooperation with the State officials and others concerned desires to assist actively in building up the fur resources.

The legislatures of 41 States were in session this year and more than a dozen considered measures affecting their fur animals. It was possible for the Biological Survey, in response to requests, to assist several State game commissions and other officials and conservation societies in drafting proposed new laws and revising old ones for the protection and propagation of fur bearers.

Other cooperative work included the attendance of representatives of the bureau at meetings of conservationists, fur traders, and fur farmers, where, upon request, information and suggestions were given and cooperation enlisted in matters affecting the

protection of the source of supply of the raw materials of the fur industry.

The bureau has kept in close touch with the National Association of the Fur Industry, the American National Fox Breeders Association, and the Canadian Silver Fox Breeders Association, and when requested has sent representatives to their meetings. Encouragement has been given to State fox breeders' associations to affiliate with the American National Fox Breeders Association in order to build up a stronger and more efficient supporting organization. The American and the Canadian silver-fox breeders' associations have been encouraged to enter into a reciprocal arrangement with regard to the registration of purebred silver foxes.

The annual fur-law bulletin was published during the year as Farmers' Bulletin No. 1445.

STATISTICS OF FUR

Basic statistical data regarding the annual catch of fur animals and the trend of the fur trade have been assembled during the year under a cooperative agreement between the bureau and the National Association of the Fur Industry, the results to be published by the latter in its Yearbook for 1925. The preliminary work was nearly completed at the end of the fiscal year, but the study will be continued with a view to departmental publication from time to time of the information gathered and the deductions made. In this undertaking, which is essential to a grasp of the conditions underlying fur trapping and the fur industry, the bureau desires the cooperation of all agencies interested in the fur resources, of other countries as well as this.

FOOD HABITS RESEARCH

ECONOMIC STATUS OF FISH-EATING BIRDS

Pelicans.—As a part of the intensive study of fish-eating birds, which for some years has been carried on by the Biological Survey, an important field project was conducted at Pyramid Lake, Nev., during the past fiscal year. Since time immemorial a large colony of white pelicans has nested on Anaho Island in that lake. The colony now numbers about 10,000 adults, which, by reason of interference by man, natural enemies, and the elements, rear less than 1,000 young a season.

Complaints had been made that the pelicans at Pyramid Lake were serious enemies of trout, the most prized fish of the region. These charges were disproved, however, since only two trout were found in the food of the pelican colony during the entire course of a three-months' investigation, and indications were that they had not been caught alive, but had been picked from a number of dead fishes observed at the time in stagnant pools along the lower Truckee River. The fishes most often caught are the abundant species that swim near the surface of the water, the usually deep-lying trout being beyond reach of the white pelicans, as these birds rarely dive.

The findings in this investigation are similar to those resulting from studies of pelicans in other regions. The birds seem to subsist almost exclusively upon coarse and common fishes not used as food by man, and instead of doing the vast damage their size and fishing expertness suggest, they are practically harmless, even in those few places where they do exist in numbers. At Pyramid Lake, lake minnows, carp, and lake chubs are the staple foods of the pelicans, with red suckers, Sacramento perch, and catfish distant seconds in point of quantity consumed. The loud complaints against the white pelicans of Pyramid Lake, as in the case of the brown pelicans in Florida, are generally based on the fact that overfishing with nets or other means has greatly reduced the fish supply, and the blame is placed on these birds rather than where it belongs.

Night herons. — Another important study of fish-eating birds was conducted on the Mashpee River, Mass., where night herons, probably stragglers from a large colony at Barnstable, were charged with being destructive to trout. Examination of the stomach contents of 35 of the birds showed no evidence in support of the charge, a result agreeing with careful study made by other investigators of the food of these birds in the extensive rookery at Barnstable. There is no evidence that night herons in Massachusetts ever catch trout except where large numbers of the fishes are confined in small ponds, as at fish hatcheries, and there is already in effect under the Federal migratory-bird treaty act authorization for owners or superintendents or their employees to destroy the birds at fish hatcheries.

Mergansers and great blue herons.—An investigation of mergansers, or sheldrakes, and great blue herons in Maine showed that both species were

feeding on trout, and recommendations were made that full-salaried employees of the State game department be permitted to shoot birds of these species, but that the great blue herons should not be killed or disturbed in or near their nesting colonies.

Cormorants.—At the close of the fiscal year a study was in progress of cormorant colonies in Minnesota and North Dakota, which are bitterly complained of by commercial fishermen.

Examinations of the stomachs of fish-eating birds received at the Washington laboratory were brought to date.

STATUS OF OTHER BIRDS

Blackbirds.—A comprehensive investigation of the relations of blackbirds to the rice industry is at last made possible through the cooperation of rice growers in the Crowley, La., region. It is planned to make this study exhaustive, in order to demonstrate the exact status of blackbirds in relation to rice and if possible to devise practicable methods of control where needed.

Herring gulls.—A study of herring gulls in Maine revealed that their reported depredations on young lambs are of very rare occurrence, and that the devouring of fish scrap spread for fertilizer is no longer of importance, since little fertilizing is now done there by this method, but that in certain years the birds do consume noteworthy quantities of blueberries. This sporadic destructiveness was not deemed important enough, however, to call for control measures at this time.

FOOD RESOURCES OF WILD FOWL

Surveys of the lakes and marshes of Minnesota were continued and good progress made. At the request of the Pennsylvania board of game commissioners Presque Isle was inspected and a report rendered on its value as a feeding ground for wild fowl and upland game birds, together with recommendations for improvement.

Back Bay, Va., where a shortage of wild-duck foods has been a matter of concern to numerous sportsmen, was surveyed and the dearth of duck-food plants was determined to be due to an increase in the salinity of the water. The State of Virginia, in cooperation with sportsmen interested in the area, has constructed a barrier which is expected to keep out storm tides from the ocean, the principal source of the salt.

Local inspections of wild-duck food conditions were made also in two localities in Maryland and suggestions made for improvement.

EXAMINATION OF STOMACHS OF BIRDS

The contents of 2,628 bird stomachs and of 256 owl pellets were analyzed during the year. Nearly two-thirds of the stomachs were of English sparrows, advancing the study of the stomachs of this species on hand and making a total of nearly 10,000 stomachs of this species examined. This study, to ascertain the present-day status of the English sparrow, has been in progress for some years, and the number of stomachs examined, far larger than has ever previously been used to determine the economic status of any bird, should be sufficient to yield definite and conclusive results.

Among examinations of special lots of bird stomachs for correspondents of the bureau may be mentioned buff-breasted sandpipers from Manitoba, wild ducks from Louisiana for the State conservation commission, and ruffed grouse from New York for the State college of forestry.

PROPAGATION OF GAME BIRDS

Supplementary to inspections made in the latter part of the previous fiscal year, visits were made to additional game farms in New York, New Jersey, Pennsylvania, and Virginia for the purpose of studying methods of propagating game birds. The information gained on these trips, together with data compiled from various published sources, has been incorporated in a manuscript for publication on the propagation of game birds.

COOPERATIVE QUAIL INVESTIGATION

The cooperative quail investigation being carried on by the Biological Survey and a committee of sportsmen in southern Georgia and northern Florida is now well along in its second year, and interesting and valuable results continue to be obtained. Eighty-five quail nests were studied during the year, the majority by visiting them as frequently as circumstances allowed, and a few from observation blinds. Many detailed data were gathered on the bobwhite's habits and behavior during the nesting season.

It was found that 60 to 75 per cent of all nests in which eggs are known to have been deposited were destroyed by the numerous enemies of bobwhite. Many of the landowners have started

a campaign against the mammals found to be responsible for the greatest damage. A trap has been developed and thoroughly tried out at the field headquarters of the investigation and built in sufficient quantity to be used with great success on many of the plantations.

A total of 1,139 native quail were netted or trapped and banded during the year, the exact locations being marked on large-scale maps of the areas where the work was carried on. Of the Mexican quail released on one of the large preserves, 323 were carefully banded also and will be traced through this method. Other birds, to the number of 1,021, principally small seed-eating species wintering or resident in the region, were incidentally caught and banded. A few important returns from the banded quail have been reported, but no great numbers are expected until the next and following shooting seasons. Valuable and interesting information, however, has already been obtained by retrapping banded birds.

Six hundred and sixty-two crops and gizzards of quail have been collected and temporarily preserved, by far the larger number from birds shot by sportsmen during the winter months, and all preparations completed for analyses of their contents, which has been barely begun. Many quail were carefully examined during the hunting season and a series of weights and other statistics gathered.

As a basis for the food study, effort has been made to complete as far as possible the reference collection of seeds and seed-bearing plants of the region, and of insects likely to be eaten by quail.

Complete propagation equipment, patterned after that in use on the Virginia State game farm, where thousands of young quail are being raised, was built to accommodate 10 pairs of breeding quail and their expected progeny, and experimental propagation is being carried on at the headquarters of the investigation. Experiments are being carried on also with skunks, opossums, raccoons, weasels, and other mammals, and of reptiles suspected of destroying the nests and eggs of quail, and 10 pens for their accommodation have been built, as well as a large pen in which the actual experimenting is conducted.

A pamphlet detailing the progress of the investigation during its first half year was published by the cooperating committee under the title "Progress on Cooperative Quail Investigation, 1924."

MISCELLANEOUS INVESTIGATIONS

Plans to investigate the reported destruction of birds by insect-poisoning operations in cotton fields were rendered largely futile by drought, which itself kept down the numbers of boll weevils and made poisoning unnecessary.

The increasing use of cyanide dust against pests, together with reports of its successful use against objectionable roosts of birds, suggested its trial where birds are roosting about buildings. In experiments on starlings and pigeons it was found that great execution can be effected where the roosting site is protected from air currents and more or less overhung by structures that will partially confine the gas.

Brief field investigations not previously mentioned included inquiry into reported damage to newly sown grain and to small fruits by band-tailed pigeons in Washington, Oregon, and California, and alleged destruction of trout by mergansers in California. The results of field investigations of these complaints usually failed to substantiate the charges.

Manuscripts submitted for publication during the year in addition to that on the propagation of game birds, previously mentioned, were an extensive treatise on the local control of birds with special reference to crop protection and a brief one on natural land values for incorporation in a general report on the pine-woods section of the southern United States.

A department bulletin on "Food Habits of Some Winter Bird Visitants" was published during the year, and there were in press at the close of the year bulletins on "Food of the American Phalaropes, Avocets, and Stilts," "Food Habits of the Vireos, a Family of Insectivorous Birds"; and "Homes for Birds."

FOOD OF MAMMALS AND AMPHIBIANS

Stomachs of mammals examined during the year included those of deer from the Kaibab National Forest, where large numbers of these animals were threatened with starvation; of various small mammals, mostly skunks, for the Museum of Vertebrate Zoology, Berkeley, Calif.; and of a mountain lion from the State of Washington, which contained human remains and constitutes one of the very few

authentications of attacks of this animal upon man.

Stomachs of 340 toads, frogs, and salamanders were examined during the year. In all, the contents of the stomachs of about 2,900 toads have been analyzed, representing 29 species and all forms found in North America north of Panama. Fourteen species of the more uncommon West Indian toads were not available, but all the others were studied, and every species occurring within the United States was represented by an adequate series. The food taken by toads is so varied that it required nearly 10,000 index cards to record the information obtained. The preparation of itemized lists of stomach contents of the various species is now in progress and the tabulation of percentages of types of food has been completed.

BIOLOGICAL INVESTIGATIONS

Field investigations and technical laboratory studies of North American birds and mammals have occupied much of the time of the scientific force of this division throughout the year. Assistance in solving problems of identification, distribution, migration, and life histories of birds and mammals has been given on request to scientific and educational institutions, public and private museums, and individuals throughout the country, and to some extent in foreign countries. More than 1,500,000 cards bearing data on these subjects and pertaining to a majority of the approximately 3,500 forms of birds and 2,500 of mammals known to inhabit North America north of Panama are now in the files of the bureau. These files, which are daily drawn upon to answer correspondence on a multiplicity of subjects, and are indispensable in the administration of the work of the bureau, represent the accumulation of many years, and, gathered as they are from a great variety of sources, they form an unequaled repository of information.

TECHNICAL STUDIES OF MAMMALS

Continued substantial progress was made on a monograph on the ground squirrels of the genus *Citellus* and their relatives, a group of animals of great economic importance because of the millions of dollars damage they do to crops and forage, and of the fact that certain species are carriers of pneumonic and bubonic plagues and spotted fever. The desirability of learning as much as possible of the distribution and habits of species of such enormous destructive potentialities is obvious.

A revision of another interesting group, the long-tailed shrews (*Sorex* and related genera), is virtually completed. These little animals, almost entirely insectivorous, are doubtless of some economic importance, although their food habits are not sufficiently known to justify the formulation of definite conclusions. Studies of the kangaroo rats of the genera *Dipodomys* and *Microdipodops*, a group of marked economic importance, are also progressing. A revision of the pikas (*Ochotona*) (North American Fauna No. 47) was published during the year, and a technical study of a typically western species of meadow mouse (*Microtus montanus yosemite*) also appeared (Journal of Agricultural Research, June, 1924).

BIOLOGICAL SURVEYS OF STATES

No important field work in surveys of States was possible except in Florida, special attention being given in the spring of 1925 to the breeding ranges of important species in the northern and central parts of the State. Data have been obtained for the preparation of an extensively annotated report on the birds of the State, and tentative plans have been made with a State institution for its publication. In several other States work primarily concerned with other lines of investigation has added important data to those previously accumulated, thus augmenting the value of the ultimate reports.

Completed manuscripts on the mammals of North Dakota and of New Mexico and on the birds of Texas and of New Mexico are still unpublished. In the case of the last named there is prospect of its publication in cooperation with State organizations, and the manuscript is now being brought up to date. Other reports well advanced include fully annotated lists of the mammals of Oregon, the birds of North Dakota, and the birds and the mammals of the State of Washington.

NATURAL HISTORY SURVEY OF ALASKA PENINSULA AND UNIMAK ISLAND

In the spring and summer of 1925 a cooperative expedition made a survey of the wild life in the western part of Alaska Peninsula and Unimak Island, the easternmost of the Aleutian Chain lying within the great Aleutian Reservation. This region lies within the northern breeding grounds of various

species of migratory wild fowl and is inhabited by many caribou and large brown bears. The rapid decrease of caribou there within recent years and the visits of many hunting parties in pursuit of brown bears made desirable a study of conditions by a competent naturalist to afford a basis for any proposed action for the further protection of the wild life in one of the least known parts of Alaska.

DISTRIBUTION AND MIGRATION OF BIRDS

Data on the movements of birds have been received from about 175 volunteer observers throughout this country and in many parts of Canada, many of whom have sent in similar reports for a number of years. A report on the distribution and migration of the swallows, a group of great economic importance, is in preparation.

During the year a circular was published on "The Spread of the European Starling in North America" (Department Circular 336). This bird is becoming familiar in the Eastern and Northeastern States, although it was established in this country only as recently as 1890. It is of local occurrence as far west as central Ohio and south to Georgia and Alabama, but many years may elapse before the bird becomes sufficiently numerous to be of economic importance west of the Alleghenies.

BIRD CENSUSES

Bird censuses, actual enumerations of pairs of birds breeding on certain representative areas, usually occupied farm lands, were received from about 70 observers, scattered over a large part of the country. The most valuable were taken on areas reported on during previous seasons, usually by the same persons. A sufficient number of such observations will make possible a useful estimate of the total bird population of the country, and to this end efforts are being made to increase the number of these volunteer enumerators.

BIRD BANDING

Notable progress has been shown during the fifth year of the bird-banding operations as carried on by the Biological Survey. As a means of gathering data on the seasonal and local movements of birds, experience with the banding method has fully justified expectations. The number of volunteer cooperators has increased to about 1,100, despite the fact that the conditions governing their selection have been made more rigid. The number of Canadian cooperators is 97. The total number of birds banded during the year was 64,253, and the number of returns recorded was 3,187, as against 40,432 and approximately 2,000, respectively, last year.

The regional cooperative associations established to promote interest among the members have shown marked activity. The Northeastern and the Eastern Bird Banding Associations have begun to issue bulletins which promise to become increasingly useful. The Inland and the Northeastern Associations have made special efforts to band gulls, terns, and night herons, resulting in the accumulation of important information. The Western Bird Banding Association was formed by a reorganization of the banding chapter of the Cooper Ornithological Club.

A report entitled "Returns from Banded Birds, 1920 to 1923" (Department Bulletin No. 1268), which appeared early in the year, gives the details of the recovery during four years of 1,746 birds of 98 species. The data obtained by banding, especially those relating to ducks and other game species, furnish important information in connection with the administration of the migratory-bird treaty act.

The cooperative expedition sent to the Yukon Delta region in the summer of 1924 afforded opportunity not only to band numbers of game birds which breed in that section and winter in the Western States and farther south, but also to obtain valuable data on distribution and breeding habits. The banding work was especially successful in the case of the cackling goose, a bird which breeds mainly in this section, and which was captured in considerable numbers by the aid of a party of resident Eskimos. From these banded birds an exceptionally large percentage of returns was obtained in a rather limited area in California, suggesting the desirability of guarding carefully such species as breed and winter in comparatively restricted areas.

GAME IN NATIONAL PARKS AND FORESTS

During the latter half of August a representative of the bureau accompanied a committee appointed by the Secretary of Agriculture to make an investigation of the conditions affecting mule deer on the Grand Canyon National Game Preserve in

Arizona. The deer were found to be in a very serious condition because of overgrazing of the range, combined with a continued increase in the numbers of the animals. Recommendations were made for the reduction of the herds to avoid further losses. These studies were followed in June, 1925, by another investigation, in cooperation with the Forest Service and the National Park Service, of the critical game problem that has developed. This work remained unfinished at the close of the fiscal year.

Late in October and early in November, in cooperation with the Forest Service and the National Park Service, an assistant made a thorough study of the elk situation in the Gallatin Valley in northeastern Yellowstone Park and the adjacent parts of Montana, with special reference to winter conditions. It was found that the Gallatin Valley could well support a larger elk population than now winter there, and measures to increase these numbers were recommended.

INTRODUCTION OF TROPICAL GAME BIRDS

Attempts were continued to capture and transport from Guatemala living examples of ocellated turkeys, curassows, and tinamous to Sapeloe Island, Ga., the expense being borne by Howard E. Coffin, who is cooperating with the bureau in the work. The turkeys obtained during the summer of 1924 all died, but it was determined to spend another season in a final effort. Reports from the field state that at the end of June more than a dozen living ocellated turkeys were on hand and that about the same number of eggs were being incubated. During the last two breeding seasons chachalacas from northeastern Mexico have bred freely in the forests of Sapeloe Island, where they appear thoroughly at home.

STUDIES OF INJURIOUS RODENTS

Fenced quadrats established in Arizona several years ago for studying the relation of rodents to agriculture, horticulture, and forestry have been kept under observation. The results of investigations of damage to range grasses by the Zuni prairie dog, based on this work, were published during the year as Department Bulletin No. 1227.

Investigations also were made of the relation of the porcupine and other rodents to reforestation in the Southwest, the relation of jack rabbits to agriculture and stock raising, and the habits of certain species of injurious rodents peculiar to the northwest coast region. The porcupine is one of the rodents now known to increase periodically to excessive numbers in certain regions, after which through an epizootic disease it may be reduced nearly to point of extermination. Porcupines in many western forests have recently become so abundant that they are destroying timber on a very large scale by girdling, and their effective control is a serious problem pressing for solution.

Studies in cooperation with the Pennsylvania Game Commission demonstrated the feasibility of capturing and moving beavers to locations where they are not objectionable.

At the instance of the Louisiana Conservation Commission a cooperative study of the status of the muskrat has been begun in that State, and interesting results are expected. Marshland areas in the southern part of Louisiana produce immense numbers of these valuable fur bearers, greater monetary returns from which might be realized if more were known of the factors governing their abundance. The bureau therefore selected a naturalist who will spend at least a year studying the life habits of the muskrat and other resources of the marshes in order to learn as much as possible of their interrelationships. This work will be supervised from time to time by representatives of the bureau.

ALASKA GAME AND LAND FUR ANIMALS

THE ALASKA GAME COMMISSION

A most notable conservation measure passed by the last session of the Sixty-eighth Congress and signed by the President on January 13, 1925, was the Alaska game law. The bill was formulated with the benefit of suggestions and advice from many sportsmen and conservationists, not only among residents of Alaska but also in the United States, who were directly interested in the maintenance of the wild life in that great area. The law is one of the most complete and effective of its kind ever enacted, and through it the game and fur resources of the Territory should not only be maintained but increased. Vast areas in Alaska are of such a character that wilderness conditions with game and fur-bearing animals will undoubtedly persist there indefinitely.

One of the most important provisions of the law was the establishment of an Alaska Game Commission of five members to be appointed by the Secretary of Agriculture, one from each of the four judicial divisions of the Territory, the fifth member under the terms of the law to be the chief representative of the Biological Survey resident in Alaska, who becomes its executive officer and fiscal agent.

The members of the commission have shown the greatest interest in the responsibilities placed in their hands, and the outcome of their first meeting, held in April, 1925, was the recommendation for adoption by the Secretary of Agriculture of a most comprehensive set of regulations governing the taking of Alaska game and fur bearers. These have been published as a Service and Regulatory Announcement (No. 1) of the Alaska Game Commission. Under the guardianship of resident commissioners appointed by the Secretary of Agriculture, who will have available for their use the vast store of information on birds and mammals in the files of the department and the close cooperation of the Biological Survey, there is a much brighter outlook for the future of Alaskan wild life.

LARGE GAME ANIMALS

Game on Unimak Island.—It is planned to hold Unimak Island, the easternmost of the Aleutian Islands Reservation, as a big-game refuge, where caribou and big brown bears may remain long after they have disappeared from many other parts of their range. This island, which is about 75 miles long and 25 miles wide and is made up of moderate slopes and broken mountain country, still maintains a considerable number of Grant caribou and brown bears. The wild life of the Alaska Peninsula may be affected adversely by the development of oil wells and other industries, and the policy of continued protection on Unimak Island should insure the perpetuation of some of the big-game animals of that region on part of their original range.

Stocking game areas.—The Alaska Legislature at its recent session appropriated $10,000 to be used by the Alaska Game Commission in stocking islands and other areas with game and fur bearers not already existing there. A general survey has been made of the opportunities, and by the stocking of many islands now lacking in various valuable species thus made possible, a considerable increase can be brought about in the game and fur production of the Territory.

Starving deer saved. — During the winter of 1925 an extraordinarily heavy snowfall on the islands of southeastern Alaska forced great numbers of Sitka deer down to the beaches, where, in serious danger of starvation, they were feeding only on the seaweed exposed at low tide. This serious situation was called to the attention of the bureau by radiograms from its employees and from the heads of chambers of commerce of Juneau and other towns, one telegram stating that 160 carcasses of deer had been found in a single locality.

Unfortunately the department had no funds which could be legally used for saving the deer, but at once brought the situation to the attention of conservationists, and a prompt response came with contributions obtained by the president of the National Association of Audubon Societies from friends, including members of the conservation committee of the Camp Fire Club of America; the president of the American Game Protective Association added $250 and the president of the American Humane Association of Albany $500, making a total of $2,319. This was promptly made available to the representative of the Biological Survey at Juneau.

A supply of baled alfalfa hay was purchased, and with the cooperation of the people of that region, including representatives of the Forest Service and the Bureau of Fisheries, trees were cut for forage, hay was distributed along beaches frequented by the deer, and other measures taken for the benefit of the starving animals, with the result that instead of the loss of whole herds, a very large number were saved to perpetuate in the region a valuable game species.

LAND FUR ANIMALS

Shipments of fur.—Despite the trapping of large numbers of fur animals every year, reports by postmasters and agents of transportation companies of shipments of furs from Alaska from December 1, 1923, to December 31, 1924, indicate that the land fur bearers continue to hold their own, except muskrats, which show a decrease of 25,558 from the figures for the year ended November 30, 1923. This decrease, together with the close season on beavers and martens, resulted in a slight decrease in the total number

and value of pelts shipped. The number exported in 1924 was 285,545, valued at $1,657,448, as against 396,369, valued at $1,702,000, in 1923. Skins brought out of the Territory as personal baggage by travelers and by vessels not reporting them, and skins of blue and white foxes from the Pribilof Islands, which are under the jurisdiction of the Bureau of Fisheries, and furs used in the Territory will no doubt bring the value of land furs taken in 1924 fully up to $2,000,000, if not more.

The number and value of the principal pelts are as follows:

Number and value of the principal pelts shipped from Alaska during the period December 1, 1923, to December 31, 1924

Kind of fur	Number	Value	Kind of fur	Number	Value
Mink	39,356	$334,526	Beaver	5,713	$114,260
Red fox	13,353	267,060	Lynx	3,323	73,106
White fox	5,728	229,120	Silver-gray fox	372	46,500
Muskrat	194,053	194,053	Cross fox	1,284	44,940
Marten	6,019	150,475	Otter (land)	1,950	43,875
Blue fox	1,640	131,200	Weasel (ermine)	10,724	16,086

Seizures and prosecutions.—Forty-three cases involving violations of the game and fur laws and regulations in Alaska were reported during the year, of which 5 were violations of the migratory-bird treaty act and regulations, 18 of the Alaska game law and regulations, and 20 of the fur law and regulations. Of these 43 cases 3 were dismissed, 3 are still pending, and in only 1 case did the grand jury fail to indict. Nineteen seizures and confiscations were made, consisting of 335 beaver skins, 6 red-fox skins, 3 guns, and 1 trap. Fines amounting to $716.50 were imposed, ranging from $10 to $200, not including costs, and three violators were given jail sentences.

Patrol work by boats.—The bureau's sea-going power boat *Sea Otter* was on extended patrol work in the administration of game and fur laws in southeastern Alaska during the year, being away from its headquarters at Juneau 207 days and traveling 7,848 nautical miles. Fur farms were visited and the fox farmers assisted and given all information possible. At the close of the preceding fiscal year a small power boat, the *Marten*, 30 feet in length, was purchased for patrol work in the enforcement of game and fur laws in the waters of southern Alaska, principally Cook Inlet. This boat traveled 2,281 miles during 97 days' absence from its base of operations at Anchorage.

REINDEER INVESTIGATIONS

Investigations among the reindeer herds continued throughout the year, covering the occupied ranges from the Yukon Valley northward along the coasts of Bering Sea and the Arctic Ocean. The assistant chief of the bureau spent most of the summer of 1924 visiting reindeer ranges as far as Kotzebue Sound to learn the conditions with which the bureau must deal. The bureau representatives assisted in round-ups of herds and conferred with native and white owners as to range management and as to means for finding a more ready market for the surplus animals. The increase in the herds has far outgrown local demands for reindeer meat, and it is becoming urgently necessary that some way be found to dispose of the surplus animals in the herds of the Eskimos as well as of the white owners by establishing cold-storage plants at proper intervals and erecting corrals with suitably constructed chutes. The natives are showing a good spirit of cooperation with the bureau's agents in working out their problems.

From surveys made during the year it is estimated that there are about 350,000 reindeer in Alaska in 110 herds. Numerous reindeer herds were visited and suggestions made for improving methods of handling the animals on the range and for the proper reduction in number and selection of bulls, and improved methods of branding and of castration.

Observations of range-study quadrats and of the abundance and distribution of forage plants continued. Many of the reindeer herds which bureau agents had visited before show marked improvement as a result of suggestions for better care and handling. Little effort has been found necessary to induce native herd owners, when once convinced, to cooperate in adopting improved methods in herd management.

The transfer of the Reindeer Experiment Station from Nome to Fairbanks will be completed early in August, and another assistant has been added to the reindeer force. Plans are being worked out to conduct the station as far as practicable in cooperation with the Alaska Agricultural College and School of Mines. It is desired to conduct investigations at the college in crossing caribou with reindeer and experiments in wintering reindeer on range forage other than lichens, as well as to make detailed plant studies and experiments in interior grazing. It is also desired to maintain under observation a small experimental herd in an inclosure within the agricultural college grounds. Cooperative studies in range management, forage, and reindeer breeding should be of material aid in the development of the reindeer industry in the Territory.

Caribou-breeding experiments. — After considerable effort 10 young caribou bulls have been placed on Nunivak Island for breeding experiments. All reindeer bulls will be eliminated from this herd and studies made of the effect on the strain of reindeer by the addition of the caribou bulls. The animals were captured and held until spring in a reindeer herd near Kokrines and then transported down the Yukon River on a barge as far as Old Hamilton, below Holy Cross, under the supervision of a bureau agent, and from that point to Nunivak Island on the bureau's schooner *Hazel*, used in reindeer work along the Bering Sea coast. In the contract for the capture of the caribou bulls for this experiment they were to be tamed and halter broken so as to lead readily. This was done without difficulty. These young bulls were distinctly larger than reindeer bulls of the same age. They were also more heavily boned than the reindeer, which should be helpful in giving the crossbred animals a heavier frame and one less subject to the injury in handling so frequent among reindeer.

The manuscript was completed during the year for a second bulletin on reindeer grazing and range management in Alaska, to bring up to date the investigations on that subject.

STOCK GRAZING ON THE ALEUTIAN ISLANDS

Owing to a comparatively mild, humid climate, there is excellent forage production on most of the Aleutian Islands, although climatic conditions are such that trees and large shrubs do not grow there. The forage production has interested certain stock growers, and eight permits have been issued by the Secretary of Agriculture to companies and individuals permitting the use of several of the islands for grazing sheep and other livestock. When properly cared for in winter, sheep thrive well on the islands and produce a heavy yield of wool. Heavy losses were experienced at first among sheep placed on the western end of Unalaska Island, but these difficulties are being overcome, and one of the flock owners reports practically 100 per cent increase of lambs during the spring of 1925. Plans are being made to increase largely the herds on the islands in the spring of 1926. Should the present favorable outlook be confirmed there will be opportunity on the islands for several hundred thousand sheep, which will thus render useful a considerable number of islands which are otherwise from an economic point of view of comparatively little value.

GAME AND BIRD REFUGES

The number of game and bird refuges under the jurisdiction of the bureau is 69, to which will be added the Upper Mississippi River Wild Life and Fish Refuge, the acquisition of which has been authorized by Congress. Inspections were made of the 5 big-game preserves and of several of the 64 bird refuges.

BIG-GAME REFUGES

The report on the status of the pronghorned antelope on the Federal big-game refuges and on other areas throughout western United States, Canada, and Mexico was in press at the close of the year and will appear as Department Bulletin No. 1346. The census of antelope for this bulletin gives a total of about 30,000 existing on this continent early in 1924, a good basis for their conservation.

Nine antelope were shipped in September to the National Bison Range, Mont.; 10 to the Niobrara Reservation, Nebr.; and 12 to the Grand Canyon National Park, Ariz.; all from Reno, Nev., collected on the open range under authorization of the Governor of Nevada. This is the first time that antelope fawns have been captured in considerable numbers for restocking purposes so promptly after birth, and the experiment was successful. A few of the fawns injured or killed themselves while in captivity, but the majority survived in fine condition.

The principal activity during the year on the big-game refuges was the disposal of surplus buffalo and elk at the National Bison Range, Mont.; Wind Cave National Game Preserve, S. Dak.; Niobrara Reservation, Nebr.; and Sullys Hill National Game Preserve, N. Dak. Some of the animals were sold for breeding or exhibition purposes, including 40 buffalo from the Bison Range to start a herd on a large estate in central California, but the greater number for their meat, owing to a lack of demand for them alive. The sale of surplus animals from the four fenced refuges netted an amount within a few hundred dollars of the cost of their administration.

The accompanying tables show the number of big-game animals on the reservations maintained by the Biological Survey:

Big-game animals on refuges administered by the Biological Survey at the close of the calendar years from 1916 to 1925 (in 1925 to June 30 only)

Year	Buffalo	Elk	Antelope	Mule deer	White-tailed deer	Mountain sheep	Total
1916	206	165	47	2	3	----------	423
1917	251	205	57	2	6	----------	521
1918	311	261	55	15	8	----------	650
1919	381	345	54	21	9	----------	810
1920	431	433	65	27	5	----------	961
1921	508	519	91	54	21	----------	1,193
1922	603	[1] 608	21	[1] 52	[1] 31	15	1,330
1923	717	[1] 657	16	[1] 62	[1] 27	20	1,499
1924	675	[1] 794	25	[1] 82	[1] 27	28	1,631
1925	723	[1] 902	30	[1] 80	[1] 27	[1] 38	1,800

[1] Estimated.

Distribution on June 30, 1925, of big-game animals on refuges administered by the Biological Survey

Kind of game	Bison Range	Wind Cave	Niobrara	Sullys Hill	Total
Buffalo	532	121	58	12	723
Elk	[1] 600	[1] 200	59	[1] 43	[1] 902
Antelope	8	12	10	----------	30
Deer, mule	[1] 80	----------	----------	----------	[1] 80
Deer, white-tailed	[1] 25	----------	1	1	[1] 27
Mountain sheep	[1] 38	----------	----------	----------	[1] 38
Total	1,283	333	128	56	1,800

[1] Estimated.

National Bison Range, Mont.—It was estimated near the end of June, 1925, that this range contained 532 buffalo, of which 64 are calves of this season, 600 elk, 80 mule deer, 25 white-tailed deer, 38 mountain sheep (20 adult animals, 8 yearlings, and 10 lambs of this season), and 8 antelope. The figures given for buffalo are approximately correct, but for elk, deer, and lambs in the herd of mountain sheep they are only estimates, since no definite count could be made.

The count of buffalo on June 30 showed 64 living calves and 8 dead, compared with 100 calves living at the same time last year. One hundred and fifty-two buffalo bulls and 24 cows, surplus animals in the herd, were killed and disposed of as meat during the fall and winter, and 45 living buffalo were shipped to other parks and ranches for breeding and exhibit purposes. Three bulls, 4 cows, and 13 calves (including those stillborn) died on the range.

The buffalo herd is now under control, so it can be moved readily from one part of the range to another. Two employees of the bureau penned two divisions of the herd, totaling 425 animals, the first day that the work of corralling was undertaken, and while in the corrals the animals could be moved from one pen to another and one or more could be separated from the herd at any time. It has even been possible to milk a couple of the cows.

Three experimental elk drives were made during the progress of corralling the buffalo, and it is believed that

after trap corrals for the elk are completed it will be possible to pen a considerable percentage of them. Elk calves seem to be numerous, and there is one albino yearling on the range. Losses in the elk herd during the year so far as known were two bulls and one cow.

Because of the difficulty of making an accurate count no increase is reported in the number of deer on the range, but it is believed that each year practically as many are lost through their jumping the outside fences as are raised.

So far as known no losses occurred in the band of mountain sheep. Ewes with lambs have been seen in the rugged section favored by sheep, but no complete count of the lambs was possible.

The antelope received at the range from Nevada in September are doing well and have the run of the pasture east of headquarters, which includes 3 or 4 acres of alfalfa.

Of birds on this reservation, Chinese pheasants and sharp-tailed grouse seem to have hatched well, but only one or two pairs of Hungarian partridges were seen during the spring, and wild ducks were fewer last fall and winter than during the previous year. The increased forage growth has given all birds much better food and cover.

Wind Cave National Game Preserve, S. Dak.—Game animals on this refuge number 121 buffalo, including 17 calves; approximately 200 elk and 12 antelope. Two old mule deer formerly on the refuge were not seen during the year. All the animals are in excellent condition and an extremely rainy season has produced better pasturage for them than at any time in 10 years.

During the winter 17 buffalo and 42 elk were killed and disposed of as meat, and 3 buffalo and 9 elk were transported to various parts of the country for exhibition and restocking purposes. Two buffalo and 5 elk died from natural causes, and 2 bull elk and 5 cows were killed accidentally. One antelope died last summer, and 1, a tame buck from Nevada, was added. The antelope are doing well and there are at least 5 fawns in the band.

Elk Refuge, Wyo.—During the summer of 1924, 452 tons of hay were harvested and stacked on this refuge. This was far less than a normal crop, because of the dry summer and lack of sufficient water for irrigation. There were 683 tons left over from the previous year, however, and the State had on hand 618 tons. The State later purchased 581 tons and pasture rights to 400 acres, so that at the beginning of the winter 2,334 tons of hay were available for feeding the elk coming to the refuge and vicinity during the winter and additional pasturage areas provided.

On October 10 a heavy three-day fall of snow forced many elk down from the mountains into the valleys, and the first band, 5 in number, arrived at the refuge on October 12. During the next few days several hundred appeared, and in January approximately 5,500 were on the feeding grounds, eating an average of 16 tons of hay a day. During the winter the elk were fed approximately 1,189 tons, of which 628 tons were Government owned and 561 tons the property of the State. Many of the elk left the feeding grounds and scattered over the refuge and adjoining ranches during the latter part of January, when the weather moderated to an unusual extent for that time of year, with warm south winds and rainstorms melting much of the snow. Some of the animals trailed back to the foothills, where they found sufficient forage during the rest of the winter, and the quantity of hay fed was diminished accordingly. The weather continued mild during the remainder of the winter, and feeding at the refuge ended on March 28. About 507 tons of hay in the stack remain on hand at the refuge, and the State has 638 tons available for next winter.

Ranches in the vicinity of the refuge, aggregating 1,760 acres, have recently been purchased by the Izaak Walton League of America, and will make additional land available to the elk and increase materially the hay harvested for feeding them next winter. A count of the elk in the Jackson Hole herd made in February and March by employees of the Forest Service, State game commissioners, and the warden of the refuge showed a total of 19,483 in the region. The fawn crop the spring of 1925 was a large one, and the southern Yellowstone elk herds on June 30, 1925, probably numbered not less than 25,000 animals. It is probable, therefore, that an extremely hard winter in the near future would bring more than 12,000 of these animals into the valley for feed, most of them to the elk refuge. If so large a number should have to be fed over a 90-day period, it is estimated that more than 3,700 tons of hay would be required.

Sullys Hill National Game Preserves, N. Dak.—At this refuge are 12 buffalo, in-

cluding 1 calf of this season, approximately 43 elk, and 1 white-tailed deer. All are in excellent condition, and the grass for them on the refuge is plentiful. A 4-year-old buffalo bull was presented to the City Park at Minot, N. Dak., and 2 surplus buffalo and 20 elk were killed and disposed of as meat.

Game birds in captivity at this refuge include: Six Canada geese, approximately 75 mallard ducks, 5 wood ducks, 6 adult Chinese pheasants, from which there has been an increase of 20 this season, and 1 golden pheasant.

A new road 17 miles long is being constructed between Devils Lake, N. Dak., and a point on the Federal-aid road in Benson County north of Sheyenne known locally as the Devils Lake-Fort Totten Highway, and the Biological Survey is cooperating with the Bureau of Public Roads in the construction of a portion of it which runs through the refuge. During the year 8,798 persons visited the refuge, and the new highway will undoubtedly greatly increase the number.

Improvements completed during the year include a winter bird house for water birds, with an acre and a half about it cleared and fenced for a bird yard, erection of additional nesting boxes for tree-nesting ducks and for song birds, and the construction of dams to make two ponds for the ducks. A pavilion was built on the picnic grounds for visitors to the reservation, the parking grounds were enlarged, and various minor improvements made.

Niobrara Reservation, Nebr.—The game animals on the reservation on June 30 included 58 buffalo; 59 elk, besides the calves of this year which have not yet been counted; 10 antelope, received in September from Nevada and in a thriving condition; and 1 white-tailed deer, which is the constant companion of the antelope. Nine surplus animals, 2 buffalo and 7 elk, were killed and dressed for market during the year.

In March, 6 wild turkeys (2 gobblers and 4 hens) were received from the Wichita Game Preserve, Okla., and placed in temporary pens until May, when they were turned out on the reservation. Prairie chickens and sharp-tailed grouse are numerous, and many nests have been found on the prairie. Two broods of grouse were reared in the alfalfa close to headquarters. As it had been four winters since they had suffered much loss, the quail were plentiful. Three combined shelters and feeding stations were provided, and quail feeding continued throughout the winter.

The Nebraska Bureau of Fish and Game, under authority from this department, built three temporary earthwork dams across the spring runs, creating three ponds in which young trout and bass have been placed, in an experiment which it is hoped will result in furnishing a valuable addition to the fish production of the State.

BIRD REFUGES

Regulations pertaining to the collection of birds and their nests and eggs on Federal bird refuges for scientific and propagating purposes were amended by the Secretary to permit the killing of predatory animals and birds of prey by employees of the Biological Survey, in accordance with the laws of the State or Territory in which situated and at such times as the chief of bureau may designate. Conditions on the 64 bird refuges administered by the Biological Survey are not detailed in the present report. A list of these refuges, together with bird and game refuges on other national reservations, has been revised during the year and will be available in mimeographed form shortly.

UPPER MISSISSIPPI RIVER WILD LIFE AND FISH REFUGE

A bill approved by the President on June 7, 1924, authorized the appropriation of $1,500,000 for the purchase of overflowed lands on both sides of the Mississippi River lying within Illinois, Iowa, Wisconsin, and Minnesota for a distance of about 300 miles between Rock Island, Ill., and Wabasha, Minn., to form a wild-life and fish refuge, the administration of the bird, mammal, and plant life to be by the Department of Agriculture through this bureau, and the administration of the fish, fresh-water mussels which are the basis of an extensive pearl-button industry, and other aquatic life to be under the Bureau of Fisheries of the Department of Commerce.

At the last session of Congress $375,000 was appropriated for use during the fiscal year beginning July 1, 1925, for initiating the purchase of lands for the formation of this refuge. The great importance of setting aside this area mainly for the benefit of migratory wild fowl and the game fishes of the upper Mississippi Valley and saving them for posterity was called to the attention of the public by the Izaak Walton League, which gave the project such enthusiastic backing that Congress responded

favorably to their desires. There is a fine opportunity here for maintaining a superb wild-life refuge, a portion of which will be held strictly as inviolable sanctuaries where the various forms of wild life may rest undisturbed. Other parts will be open to the public for shooting and fishing to the full limit possible with maintaining the purposes of the refuge.

MIGRATORY-BIRD TREATY AND LACEY ACTS

The beneficial effect of the migratory-bird treaty act in increasing the supply of migratory wild fowl continues to impress observers and to make friends of the former opponents of the law. The economic importance of the migratory birds of the United States, including a potential food value of many millions of dollars annually, justifies the widespread interest in their preservation which is manifest in all parts of the country. Conservationists and sportsmen are disturbed, however, over the future of the birds because of the fact that drainage operations continue to destroy their breeding, feeding, and resting places, and because there is an insufficient number of Federal wardens to enforce the law satisfactorily. The latter condition has resulted in an increased number of violations, including hunting in close seasons, market hunting, power-boat shooting, and wanton destruction of wood ducks, swans, and other rare and valuable birds for which the law provides continuous close seasons.

COOPERATION

In the administration of the Federal game laws and other related activities the Biological Survey has gained the cooperation of State game officials, conservation organizations, and sportsmen in practically all parts of the country. This continued friendly assistance is appreciated, especially since the funds for the enforcement of the migratory-bird treaty act are so limited that the successful enforcement of the law rests on such cooperation.

Cooperation in the assembling of data made possible the prompt publication of the annual poster on open seasons for game, the Farmers' Bulletins on game laws and laws relating to fur animals, and the annual circular containing a directory of officials and organizations concerned with the protection of birds and game. Considerable expense in printing the game-law bulletin was saved by issuing as a separate publication and sending to a more limited number of persons the text of Federal laws relating to game, which until this year has formed part of the game-law bulletin.

Statistics of hunting licenses and the revenue derived from them by the several States were compiled by the bureau and made one of the tabular statements in the latest Yearbook of the department. The figures indicate that 4,307,066 resident and 32,831 nonresident hunting licenses were issued for the season 1922–23, from which the States received on the average slightly more than $1 each. The figures for the season 1923–24, not yet published in tabular form, show that 4,357,410 resident and 35,350 nonresident hunting licenses were issued.

MIGRATORY-BIRD TREATY-ACT ADVISORY BOARD

The advisory board under the migratory-bird treaty act held its annual meeting in Washington on December 10, 1924, with 14 members present. Numerous recommendations for changes in the regulations received during the year were considered by the board, the advice and suggestions of which were very helpful in reaching decisions as to policies to be adopted. As the Biological Survey was engaged at the time of this meeting in collecting information as to present wild-fowl conditions, a number of matters were left to be decided through correspondence when the facts on which to base a decision were made available early in 1925.

Among the changes in regulations submitted to the board the following were recommended by it to the Secretary: A change in the season for hunting waterfowl in Texas, Idaho, and eastern Oregon; a change in the shorebird season in Idaho and eastern Oregon; and the establishment of an earlier season for hunting mourning doves in South Carolina. These recommendations were approved by the Secretary and the necessary amendments to the regulations are now in effect.

BAG LIMITS

During the year the bureau was urged by a number of conservationists to bring about an immediate reduction of the daily bag limits on wild ducks and geese, contention being made that the numbers of wild fowl have been so greatly reduced by hunting that the species would be in grave danger of early extermination if the recommendations were not followed. This

proposition was considered at the National Conference on Outdoor Recreation held in Washington in May, 1924, and the executive committee of the conference requested the Department of Agriculture to investigate the present status of migratory wild fowl and to gather data to be used as a basis for appropriate action should reductions of bag limits be found necessary.

Acting on this request the Biological Survey, which already had a large volume of information on the subject, began a nation-wide investigation, and by means of a questionnaire which was sent to State game commissioners, sportsmen, conservation societies, and many of the bureau's field representatives, and others, and which was also published in many sporting and outdoor periodicals, obtained much additional information relative to the abundance of wild fowl. The data gathered came from practically every section of the country and indicated that wild ducks and geese had shown a gratifying increase and that there was no ground for fearing that they were in danger of extermination. With few exceptions the heads of State game departments asserted that these birds had increased in numbers.

The Biological Survey realizes its responsibility to safeguard our migratory wild fowl from undue depletion in numbers and will continue its vigilance over the wild-fowl conditions, and will promptly recommend a reduction of bag limits whenever such action is needed.

PERMITS TO KILL INJURIOUS BIRDS

A small number of complaints are received each year alleging serious injuries to crops or other interests by migratory birds. Exercising his authority under regulation 10 of the migratory-bird treaty-act regulations, the Secretary issued an order during the year permitting growers of small fruits in Oregon and Washington, members of their immediate families, and bona fide employees to kill Lewis woodpeckers when seriously injurious to pears, apples, and small fruits, such permits to be countersigned by the chief official of the State in charge of the enforcement of fish and game laws, or his authorized representative. The officials in these States use such authorizations sparingly, and consequently few permits to kill migratory birds have been issued.

An order was also issued authorizing the commissioner of inland fish and game of the State of Maine and his regular full-salaried employees to kill merganser ducks and great blue herons for the purpose of protecting game fish in the rivers, lakes, and streams within the State. This order was based on the results of investigations conducted by the Biological Survey, already mentioned, which showed that these birds were very destructive to trout and other game fish in some localities. Such permits ordinarily have no serious effect on the total number of these birds, but the action which can be taken under them unquestionably saves large numbers of game fish.

VIOLATIONS OF THE TREATY ACT

There were 489 cases of violation of the migratory-bird treaty act pending on July 1, 1924, and during the fiscal year 570 more cases were transmitted for prosecution. Of the total of 1,059 cases, 530 were terminated by convictions, 26 were nolle prossed, 69 were dismissed, in 7 juries returned verdicts of not guilty, 1 was stricken from the docket, in 3 prosecution was abandoned, leave to file information was denied in 5 cases, in 1 a demurrer to an information was sustained, and 2 were closed by reason of the death of the accused.

Fines ranging from $1 to $275 were imposed and totaled $11,723.68. Defendants also were required in many cases to pay the costs, which sometimes exceeded the amount of the fine. Eighty-five other cases reported by Federal wardens were not forwarded for prosecution because of youthfulness of the accused, insufficient evidence, adequate fines having been imposed in State courts, or other valid reasons. A large number of cases were turned over to State authorities for prosecution where violations of the State game laws were involved. The revenue accruing to the several States as a result of such cooperation was more than $6,000.

Convictions in Federal courts were distributed as follows: Alabama, 12; Alaska, 1; Arkansas, 11; California, 10; Delaware, 2; Florida, 24; Georgia, 31; Illinois, 103; Indiana, 7; Iowa, 25; Kansas, 3; Kentucky, 13; Louisiana, 7; Maine 3; Maryland, 14; Massachusetts, 1; Michigan, 2; Minnesota, 34; Mississippi, 3; Missouri, 68; Nebraska, 5; New Jersey, 13; New Mexico, 6; New York, 3; North Carolina, 14; North Dakota, 2; Oklahoma, 2; Oregon, 1; Pennsylvania, 2; Rhode Island, 1; South Carolina, 1; South Dakota, 23; Tennessee, 5; Texas, 48; Utah, 2; Virginia, 22; and Washington, 6.

During the year migratory waterfowl, aigrettes, and specimens of mounted birds unlawfully killed or possessed and having a potential market value of about $5,000, were seized. All of the migratory game birds thus taken and fit for food were given to public hospitals or to public charitable institutions.

The ninth conviction in Federal court for hunting migratory wild fowl from an airplane was obtained in the eastern district of Texas on March 2, 1925, and a fine of $10 assessed. Seven cases involving this illegal means of hunting still remain undisposed of.

Among other cases of interest terminated during the year were one in Kansas for selling live wild ducks and geese without a Federal permit, $25; one in Illinois for possessing ducks in storage during the close season and also grebes for the purpose of sale, $275 and costs; five in Illinois for possessing ducks in storage in close season, $150 each and costs; one in Illinois for killing a robin, $25; two in North Dakota for killing ducks in excess of the daily bag limit, $25 each; two in New Mexico for possessing swans, $50 each; one in Virginia for killing curlews, $100; five in Georgia for killing doves in close season, $50 each; one in Michigan for hunting ducks after sunset, $50; and one each in Texas and Florida for serving and selling wild ducks in a restaurant, $100 each. One offender in the eastern district of Virginia charged with trapping two wild ducks was sentenced to jail for two days.

ASSAULTS ON WARDENS

Assaults on Federal game wardens by violators of the Federal law continue to occur. The latest were committed in Illinois, when Federal Wardens Kenneth F. Roahen, of Illinois, and Marquis A. Charlton, of Ohio, were fired on from ambush by a gunner who was later joined by others hunting with him during the close season. The wardens were so severely injured that they could not return to duty for several weeks. Since the passage of the migratory-bird treaty act one Federal warden has been killed and several others assaulted. Such assaults emphasize the urgent need for a Federal statute under which assailants of Federal officers engaged in the discharge of their duties may be adequately punished.

COLLECTING AND OTHER PERMITS

Beginning January 1, 1924, all permits involving the collection and possession of migratory birds except those authorizing the taking of waterfowl for propagation were made valid until revoked, so that the number issued was considerably less than in previous years.

Permits to collect migratory birds and their nests and eggs for scientific purposes numbered 187, and these, with 1,034 previously issued and valid until revoked, make a total of 1,221 outstanding at the end of the year.

A total of 240 scientific possession permits, mainly for taxidermists, were outstanding at the close of the year, 52 of them issued during the year and 188 previously.

Special permits were issued during the year to 76 persons authorizing them to possess and transport, but not to sell, specimens of migratory birds found dead or accidentally killed.

Permits to trap birds for banding purposes numbered 259, which together with 894 issued in the previous year brought the total number outstanding to 1,153.

Ninety permits were issued to 81 persons authorizing the capture of migratory waterfowl for propagating purposes, and 1,192 authorizing the possession, purchase, sale, and transportation of migratory waterfowl and their eggs for the same purposes. Of the 90 permits issued, 66 expired during the year, leaving 24 outstanding. A total of 2,732 permits authorizing the possession, purchase, sale, and transportation of migratory waterfowl and their eggs for propagating purposes were outstanding, 1,540 of these having been issued during the preceding fiscal year.

INTERSTATE COMMERCE IN GAME

One case involving a violation of the Lacey Act was disposed of in Federal court during the year and a penalty of $25 imposed. Although no new cases were reported for prosecution, extensive cooperative work with State authorities in the enforcement of State laws with reference to fur animals was conducted and was very helpful in reducing illegal activities of poachers. As a result of investigations by Federal wardens either alone or in cooperation with State wardens, evidence involving 1,000 apparent violations of State laws was referred for prosecution in State courts. Services of particular value were rendered the game departments of Minnesota and North Dakota by Federal game wardens, who, on request, were assigned by the bureau to aid special agents of these States at St. Louis,

Chicago, and St. Paul, where about 700 cases of illegal shipments were uncovered.

The experience of the Federal wardens in the Lacey Act work and their intimate knowledge of the activities of many fur dealers and of conditions in the fur trade were of great assistance in the successful outcome of the cooperative investigations. In 64 investigations closed by State authorities during the year, fines and costs totaling $2,060.55 were imposed and, in addition, contraband furs were seized in some instances. Sixty-five Federal investigations were pending at the close of the year.

Considerable sentiment has been encountered among fur dealers in favor of an amendment to the Lacey Act to authorize Federal wardens to seize illegally transported skins and furs. This would facilitate cooperation with the various State game officials also, and enable the Federal Government to comply with the many special requests for the examination of shipments en route or at destination and seizure of skins taken or shipped illegally. The need of suppressing this traffic is plain, as such illegal shipments are usually of skins of fur bearers taken in States where these animals have become so reduced in numbers by overtrapping that a close season is declared to permit them to increase. Poachers take advantage of this and still further threaten the existence of the species which it is desired to protect.

IMPORTATION OF FOREIGN BIRDS AND MAMMALS

1925

ENTRIES UNDER PERMIT

The importation of foreign birds and mammals continues to show an increase over previous years. The number of permits issued during the year was 981, an increase of 240, and the number of shipments inspected increased from 232 to 239. Seven additional permits were issued for the entry of 214 miscellaneous birds at Honolulu, Hawaii. The total number of birds imported was 451,908, of which 34,470 were entered without permits.

Mammals.—Permits for the importation of mammals included 8,424 foxes from Canada, a great increase over former years, figures for which are as follows: 4,871 in 1924, 2,753 in 1923, 2,064 in 1922, and 1,574 in 1921. These importations, practically all for ranches, indicate the growth of the fur-farming industry in the United States.

Among notable mammals entered during the year was an echidna, from Australia.

Birds.—As a whole, the year showed increasing shipments of birds. On the Pacific coast there has been a marked increase in the receipts at Seattle and a slight increase at San Francisco, the birds entered at both ports being mainly from the Orient.

Importations of game birds included 39,170 Mexican quail, 3,044 Hungarian partridges, and 93 bamboo partridges, but otherwise the number of game birds brought in was comparatively unimportant. The shipment of Mexican quail was the largest since importations from Mexico began in 1910. The demand for Hungarian partridges was heavy, but after a few shipments an embargo was placed on the birds by authorities in Czechoslovakia, the main source of supply, and almost immediately the entries ceased.

Cage birds, as usual, formed the principal part of the importations and consisted chiefly of canaries and parrots. The canaries numbered 310,297 and the parrots 53,964.

Through efforts of some of the larger importers, concessions were obtained from local authorities in Abyssinia permitting the capture and shipment of birds, including several species not hitherto seen alive in the United States. This remote section of Africa, which thus far has been practically a sealed book, has now been opened up and some of its rarities made available for zoological gardens in this country. Among the birds thus imported for the first time, except a few starlings in 1924, were Abyssinian starlings (*Spreo superbus*), Abyssinian barbets (*Trachyphonus margaritatus*), and parrakeets (*Agapornis taranta*). Other interesting birds included 4 Pucheran guinea fowl (*Guttera pucherani*) from other parts of Africa, 3 Bennett cassowaries (*Casuarius bennetti*) from New Britain, some bleeding-heart doves (*Phlegoenas luzonica*) from the Philippines, and 8 sand grouse (*Syrrhaptes paradoxus*) from Central Asia.

Preliminary investigations with a view to preparing regulations governing the importation of certain cage birds were made during the year for the purpose of preventing losses from overcrowding in shipments. Canaries and most parrots are imported either in separate cages or with only a few birds in a cage, but some of the smaller weaver birds and finches are crowded in such numbers into boxes of various sizes and shapes that losses are unavoidable. Under such cir-

cumstances the weaker or smaller birds are injured by fighting, inability to obtain sufficient food and water, or lack of ventilation. Conditions can probably be radically improved and losses avoided without causing any appreciable hardship on the importers.

Eggs of game birds.—During the year 19 permits were issued for the importation of 2,695 eggs of game birds from foreign countries, chiefly eggs of pheasants from England and from Ontario and British Columbia, Canada; of ducks and grouse from Alberta; and of grouse from Norway. The largest shipments comprised 1,000 pheasant eggs from England, which arrived at New York on June 1; 200 pheasant eggs from Hamilton, Ontario, at Buffalo, N. Y., May 8; and 100 wild-duck eggs from Leduc, Alberta, at Portal, N. Dak., May 15. About half the shipments were English pheasant eggs from Europe or Canada, evidently imported for the purpose of introducing new blood into local stock. The grouse eggs from Norway were consigned to Illinois; the partridge eggs from Alberta to California; the pheasant eggs from England to Ohio; and the duck eggs from Canada to Wisconsin, Louisiana, New York, and Rhode Island.

Mexican quail.—The entry of quail from Mexico, as in 1924, was regulated through permits issued by the Mexican authorities, and instead of being collected near the border the birds were obtained from several of the States in northeastern Mexico. This year the total number to be exported was determined beforehand, concessions were granted to a limited number of shippers, and the destination of the birds stated in the permits. On request from the Mexican authorities, the Biological Survey cooperated in seeing that these conditions were carried out and furnished a report of the importations at the close of the season. The total number of quail brought in was 39,170, the largest number ever imported in a single season. Entries were limited to the two ports of Brownsville and Laredo, Tex., and of the total, 36,390 birds were brought in at Brownsville and 2,780 at Laredo.

The first importation arrived on February 11, and entries continued until the close of the season on April 30. The birds were examined by an inspector of the Bureau of Animal Industry at the port of entry, but no quail disease was reported during the season. Weekly reports were made on the condition of the birds and the destination of shipments, thus furnishing a more complete check than has hitherto been available on the destination of the entries. Most of the birds were shipped to six States, as follows: Pennsylvania, 5,848; Kentucky, 3,886; Illinois, 7,408; Oklahoma, 4,261; Mississippi, 1,634; Texas, 14,070; and miscellaneous States, 736.

The total number of quail imported from Mexico since shipments began in 1910 is now 229,029. Most of these birds were bobwhites, but a few were scaled quail. Inquiries were received this year regarding the importation of the Gambel quail from Sonora, and valley quail from Lower California, but no importations actually crossed the border.

PROHIBITED SPECIES

Two cases of entry of prohibited species occurred during the year. A newspaper clipping was received from a western correspondent containing the illustration of a mongoose said to be in the possession of a student at the University of Wisconsin. The matter was at once taken up with the Customs Service, and through the collector of customs at Milwaukee an investigation was made and the animal located, identified, and promptly killed. Further investigation disclosed that this mongoose had been entered on or about February 11, 1924, under the name "honey bear," at Brooklyn, N. Y., and had subsequently been presented to the student.

Early in June, 1925, application was received for the entry of five mongooses, all males, which had been brought from Calcutta by the captain of a steamer for the owner of a private game preserve in New York. The consignee was advised that the animals could not be landed, and on June 13 they were reshipped to India.

These are the first cases of prohibited species reported for 10 years (not counting a Philippine paradoxure, which was killed in California in 1923), the last ones occurring in 1914. One was a mongoose discovered at Philadelphia in November, and the other one at San Francisco a few weeks later. The infrequency of attempts to import the mongoose and other proscribed species indicates continued vigilance on the part of officers of the customs and general knowledge of the existence of the law prohibiting such entries.

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